11 ECONOMIC VALUATION OF THE RECREATIONAL SHORE FISHERY: A COMPARISON OF TECHNIQUES

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Abstract

This chapter describes work to determine the economic values associated with the recreational marine line fishery in Namibia. This highly esteemed fishery involves angling from the shore with bait for bottom-feeding fish, mostly kob, steenbras and galjoen. Anglers come from South Africa (46%), inland Namibia (38%) and coastal Namibia (16%). In 1997 and 1998 several field surveys and valuation approaches were applied to the fishery. A roving creel survey was used to determine angler numbers and catches. Responses from two questionnaire surveys involving 240 and 372 anglers, respectively, were analysed to estimate angler expenditures, consumer surpluses, and the price elasticity of demand. Both the travel cost and the contingent valuation methods were used. Some 8,300 anglers spent a total of 173,000 days angling, and each angler spent some N$3,400 in this activity. Aggregate direct expenditures by anglers were between N$23 million and N$31 million. Gross value added associated with this was between N$11 million and N$15 million. This represents 2% to 4% of the whole fisheries sector, which itself makes up 4% of the economy. The aggregate consumer surplus enjoyed by anglers was N$24 million, of which 30% to 50% accrued to foreigners. Demand for angling is price inelastic, making it possible to capture rents from the fishery. Results from the different valuation exercises showed considerable convergent validation. All methods are best employed together, but each alone can provide useful values for policy analysis.

INTRODUCTION

The Benguela system, described in detail elsewhere in this volume, is characterised by cold but nutrient-rich upwellings, relatively low species diversity,

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and high production. It forms the basis for a highly esteemed recreational fishery. Anglers mostly fish from the shore, in the surf, using bait. Most frequently landed are kob (mostly silver kob, *Argyrosomus inodorus*, Sciaenidae, but also dusky kob, *A. coronus*), west coast steenbras (*Lithognathus aureti*, Sparidae), galjoen (*Dichistius capensis*, Coracinidae) and blacktail (*Diplodus sargus*, Sparidae). To a lesser extent, sharks are targeted, including the copper shark (*Carcharhinus brachyurus*, Carcharhinidae), the spotted gulley shark (*Triakis megalopterus*, Carcharhinidae) and the smoothhound (*Mustelus mustelus*, Carcharhinidae).

Access to shore angling on the Namibian coast is restricted to about one quarter of the coastline: 90% of angling is in the West Coast Recreation Area (WCRA), some 260 km, stretching from Sandwich Harbour, south of Walvis Bay to the Ugab River in the north, but additional small sites exist at Torra Bay and Terrace Bay to the north, and Lüderitz in the south. Anglers originate from coastal Namibia, inland Namibia, and South Africa, of whom very small numbers fish for subsistence. Recently, in 2001, angling licences were introduced, and the daily bag limit of 30 fish (or 30 kg of fillet) was reduced to 10 fish (or 10 kg of fillet).

The recreational line-fish resource is shared with a commercial line fishery, which operates inshore, from Walvis Bay, in some twelve vessels. These vessels target the same species, but also seasonally seek the pelagic snoek (*Thysites atun*, Gempylidae). The stocks are perceived to be declining (Kirchner, 1998; Holtzhausen, 1999; Holtzhausen *et al.*, 2001). There is a need for economic data on the fishery, to inform sound policy development, planning and management. This chapter reviews and compares work done by ourselves, notably Kirchner *et al.* (2000) and Zeybrandt and Barnes (2001), on the economic valuation of the recreational shore fishery. The review is focused on comparing results from the different methodological approaches.

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Methods

Economic values

The values (measured in Namibia dollars (N$))[1] can be placed in the context of "total economic value" for natural resources. Total economic value consists of *use values*, which embrace direct and indirect use values, and *non-use values*, which embrace option, bequest and existence values. Pearce and Turner (1990) describe these components. All of our measures of gross output, value added, and consumer surplus given reflect *direct use value*.

In Namibia, a primary macro-economic measure of direct use value is the gross national income (GNI). This can be estimated either as the total value of consumption of all final products in the economy, or as the total value added by all productive activities in the economy. Value added in an enterprise is defined as the return to internal factors of production (labour and capital), and is the gross output less expenditures on external factors (intermediate expenditures). Net national income (NNI) is gross national income less capital asset depreciation.

Central to the recreational fishery is the activity of angling. The total direct expenditures made by the fishers in angling make up the gross output of the fishery. The value added for the fishery is a proportion of the output. We had no measures of this proportion for angling tourism, but were able to extract estimates from the broader nature-based tourism sector in Namibia. Empirical data collected during the 1990s (Ashley, 1995; unpublished data, Environmental Economics Unit, Directorate of Environmental Affairs, Ministry of Environment and Tourism) showed that gross value added was 48% of gross output, and net value added was 41% of gross output. We applied these proportions to calculate gross and net national income for the recreational fishery.

Instead of simply determining the "value" of the fishery, we can measure its "impact" on the economy. Here, we determine the values generated by primary direct expenditures, plus those resulting indirectly through induced linkages and further rounds of spending. Although Kirchner *et al.* (2000) did employ a crude national income multiplier to estimate impact, we do not include it here.

Price levels for outdoor recreational activities are often set lower than those the users are willing to pay. Any positive difference between the price paid by a user and his/her willingness to pay is the user's *consumer surplus*, and it forms part of the economic direct use value of the activity. We used the travel cost and contingent valuation methods, described below, to measure this component of value.

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[1] At the time of the studies, N$1.00 was equal to ZAR1.00 or approximately US$0.20

Surveys

The first of three surveys was a roving creel survey, to determine relative angler numbers and catches (Kirchner *et al.*, 2000). Sampling was conducted from October 1996 to September 1997. Sampling was stratified to capture differences between the high and low seasons, as well as to adequately cover six spatial zones. Data were analysed to estimate the mean daily number of anglers and mean daily catch, for all angler categories. Lüderitz, where angler numbers are very low, was left out of the study.

The second survey involved a targeted sample of 240 anglers, 80 from each of the three categories: coastal Namibians, inland Namibians, or foreigners (South Africans), who were interviewed, while they were fishing, to determine their daily expenditures. The sample was made within the West Coast Recreational Area by two researchers. Subsistence anglers were few in numbers, very localised, and were left out of the survey. Foreign visitors were asked to estimate costs of fuel, accommodation, bait, tackle, groceries, refreshments and entertainment, in addition to costs of any fishing equipment purchased in the last calendar year within Namibia. Anglers from inland Namibia were asked to estimate the same costs, excluding those for groceries. For coastal residents, the costs of fuel, bait, tackle and equipment purchased within the last calendar year were included in the analysis.

The third survey involved a sample of 626 anglers made at angling destinations, from Walvis Bay in the south to Terrace Bay in the north, to determine trip expenditures and willingness to pay for angling and conservation (Zeybrandt and Barnes, 2001). The survey took place between January and April 1998. Sampling was not systematic or random, but non-selective at sites, with the aim of getting the highest possible number of responses. Stratification of sampling between sites was undertaken, aimed at achieving representative spatial coverage.

The sample contained different proportions of angler categories (foreign visitors, inland Namibians and coastal Namibians) from those measured in the roving creel survey (Kirchner *et al.*, 2000). This sample bias was corrected for by weighting the results for the three segments. The questionnaire used in the third survey was similar to that used by Barnes *et al.* (1999) and Barnes (1996) to survey broader tourism populations and wildlife viewing tourists. It was designed to elicit data, for both travel cost and contingent valuation analysis. In addition to general tourist characteristics and reasons for the visit, respondents were asked to state their travel costs, total costs, specific angling costs such as bait, tackle, rods and reels and the replacement cost of their vehicle/skiboat (if any). A team of five enumerators distributed questionnaires, assisted respondents when needed, and collected completed questionnaires. The questionnaire was in most cases handed out to respondents for their own completion, but some regular interviews were held. Re-

fusal rate was very low. From 626 returned questionnaires, 372 were selected for use after cleaning.

Analysis

Expenditure analysis. Data from the second survey of 240 anglers were used to estimate mean daily expenditure and expenditure per fish caught, for the three categories of recreational angler. Data from the third survey of 626 anglers were also used to extract details of direct expenditures on the angling experience. Here, the questions had been designed to form the base for the development of travel cost and contingent valuation models. These analyses are explained in detail by Zeybrandt and Barnes (2001) and below.

Travel cost analysis. In travel cost analysis, anglers' costs of consuming the services of the environmental asset are used as a proxy for price. These consumption costs include travel costs, entry fees, on-site expenditures, and the annualised costs of outlay on capital equipment needed for consumption. The basic premise is that the user population is homogeneous in its willingness to pay, and that differences in the costs of consumption (due, for example, to different travel costs) result in different rates of visitation. The visitation rate is used as the quantity measure of the angling experience. The travel cost method is thus an *indirect* method of valuation. By varying the travel costs and visitation rates, it is possible to derive a demand curve that expresses the demand for trips to the recreational area (Kerr, 1986; Hanley and Spash, 1993). The consumer surplus for the activity can be calculated from the demand function.

The travel cost method has not been used much in the context of southern African tourism activities, because it depends for success on assumptions, which are commonly not applicable. We considered the Namibian angling population to be suitable for analysis using the travel cost approach, because the angling population is relatively homogeneous, visits are made exclusively for angling, and substitute sites are remote and somewhat different.

Depending on the degree of homogeneity of the sample population regarding travelling distance and social characteristics, an *individual* or *zonal* travel cost model can be used. Our data were best suited to a zonal model, with highly variable costs and variable frequencies of visitation. For zonal models, population figures are derived for the zones and numbers of visits per capita, per zone are calculated. A typical zonal visitation rate model is:

$$(VPC)_{zj} = f(TC_{zj}, S_z) \quad (1)$$

where $(VPC)_{zj}$ is visits per capita from zone z to site j, TC_{zj} is trip (including travel) costs from zone z to site j; and S_z is a vector for the social characteris-

tics of the zone *z*. It is assumed that the visitors travelling from different zones have the same willingness to pay and the same social characteristics. The zonal model is somewhat sensitive to the selection of the zones used. This can affect the resulting consumer surplus estimates (Hanley and Spash, 1993).

Thirteen geographical zones were identified for our model. These were made up of South Africa's nine provinces, three Namibian coastal zones, and one Namibian inland zone. The populations and mean incomes for the South African zones were derived from data from the South African Centre for Statistical Services (CSS). The populations for zones in Namibia were derived by adding the populations for each city or town in the zone represented in the zone samples. No official estimates of local Namibian incomes were available, and these were derived from the questionnaire data.

The travel costs included the fuel cost of a return trip to the Namibian coast and the on-site expenditure. We considered that the fuel costs only, rather than full cost of the vehicle (including depreciation of the car, tyres etc.), was closest to the typical respondent's perception of vehicle costs. A contentious issue regarding travel cost models relates to the inclusion and estimation of opportunity costs for travel time. Hanley and Spash (1993) suggest inclusion of a question about enjoyment during travelling, and imputing opportunity costs only to those not enjoying the travel time. Because 95% of our respondents enjoyed the time travelling, we included time costs for only 5% of respondents in the basic model.

The cost of time for the South African zones was determined by deriving hourly income from mean zonal incomes, as acquired from the CSS. For Namibian zones, mean incomes from questionnaire responses were used. The travel cost was determined by multiplying the distance travelled to and from the coast with the Automobile Association of South Africa's (AARSA, 1998) estimate of cost per km for two-wheel-drive and four-wheel-drive vehicles. Time costs were computed assuming average travel speed of 70 km per hour.

The inclusion of on-site and other non-travel costs such as accommodation or entry fees, is also contentious. Whether these should be included depends on whether they can be deemed to affect rates of participation and, as with travel time, the degree of enjoyment derived from the consumption. We considered that, along with the cost of travel, these expenditures overwhelmingly *do* affect visitation rates, and therefore should be included in the analysis.

Many travel cost models (e.g. Navrud and Mungatana, 1994) include social characteristics such as gender, income, and other relevant variables to obtain better specification for the model. In our case, lack of data and problems with multicollinearity precluded this. Different functional forms were

tested. The model that had the "best" fit was chosen for the following stages of the analysis, i.e. developing a second stage demand function (Kerr, 1986; Hanley and Spash, 1993), and calculating the consumer surplus.

Contingent valuation analysis. Data from the third survey of 626 anglers were also analysed using contingent valuation, to estimate consumer surpluses (Zeybrandt and Barnes, 2001). Unlike travel cost, which is based on revealed preferences, contingent valuation is a *direct* method and is based on stated preferences. In it, the respondent's willingness to pay (WTP) for an increased amount of a specific good, or her/his willingness to accept (WTA) to avoid a decrease of a good, are elicited through surveys. It is generally agreed that willingness to pay is preferable to willingness to accept (NOAA, 1993; Mitchell and Carson, 1989).

We used a variation of the contingent valuation method, which Barnes *et al*. (1999) and Zeybrandt and Barnes (2001) describe in some detail. Among general questions on their personal characteristics, origin, trip and trip preferences, respondents were asked how much their *travel* to and from their angling destination was costing, what their *total angling trip* was costing, how much of this they were personally spending within Namibia, and what their annual income was. They were informed that their answers were to assist with planning and could not affect actual prices.

A payment card was used to ask the respondents what they would be willing to pay for a *similar, return,* angling trip. They were first asked whether their current trip was value for money and then whether they would be willing to return on a similar trip. If they said "yes" (nearly all did), they were asked to identify the cost level (in relation to their present or actual cost) that would *prevent* them from returning. If they said "no", they were asked to identify the cost level (also in relation to their actual cost) that would *induce* them to return. These cost levels were taken as the maximum willingness to pay for a return trip. For each respondent, a positive difference between willingness to pay for return trips and actual trip cost was taken as an estimate of that individual's consumer surplus for the whole trip. For foreign anglers, the consumer surplus for the Namibian part of the trip was calculated proportionally, based on the ratio between expenditures for the *whole trip* and the *Namibian component of the whole trip*.

The cost of travel and the cost of the overall trip were common to all respondents, and most seemed able to make a good estimate of these. They were first asked for these two costs in that order, before being asked to value any other specific components of the trip such as accommodation. The order of questions was selected with care after the pilot survey, and was thought to reduce the potential for both *budget constraint* bias (Mitchell and Carson, 1989) and also *embedding* or *part-whole* bias (Navrud and Mungatana, 1994;

Kahneman and Knetsch, 1992). Focus on the *overall* trip cost for the willingness to pay question was also thought to reduce the tendency for these biases (Moran, 1994; Navrud and Mungatana, 1994).

Getting anglers to focus on *return* trips in their consideration of willingness to pay was thought to reduce confusion between actual and maximum estimates, which might arise if they were to focus on the *actual* trip. In as much as desire for return trips is likely to be less than that for *first time* trips, the estimates of actual demand and consumer surplus are likely to be conservative. We consider this of value in reducing any effects of *avidity* bias, as described by Thomson (1991).

Use of the actual angling experience as the reference point, and the use of the words "prevent" and "induce", was thought to reduce the possibility of *strategic*, *mis-specification*, *compliance*, *starting point*, *range*, *relational* and *positional* bias, all described by Mitchell and Carson (1989) and Zeybrandt and Barnes (2001). To avoid possible sponsor bias, respondents were informed that the study was an environmental evaluation of recreational angling. Care was taken with the order of questions, to minimise the possibility of embedding or part-whole bias. In order to corroborate the results from the payment card, we also used an open-ended question, where we asked the respondent to state his/her maximum willingness to pay for the return trip.

Price elasticity. We derived measures of price elasticity from the data and the demand functions developed using the travel cost and contingent valuation methods. First multiple and then simple regressions were run on the raw variables, to try to determine price, income, success and other elasticities. Secondly, the second-stage demand functions from the travel cost analysis were used to calculate price elasticities. Thirdly, the variable for willingness to pay, obtained in the contingent valuation study, was manipulated to develop a derived demand function, which was also used to calculate price elasticities. In this case, the range of willingness to pay was divided into 20 equal segments, and a frequency histogram depicting the distribution of responses along the range was drawn. Simple regression on the histogram data was carried out to obtain the *price* (willingness to pay) to *quantity* (number of respondents per price category) relationship.

Double log, lin-log, log-lin, linear and reciprocal functional forms were tested for both multiple and simple regression models. In multiple regressions, different combinations of explanatory variables were tested in an attempt to minimise multicollinearity effects. Only models displaying significance, overall and with respect to the coefficients, were retained. Point elasticities, at mean and median price values, were calculated for all other than double log functions.

Results

Data from the roving creel survey revealed that some 8 300 anglers spent some 173 000 days angling on the Namibian coast during the 12 months of the 1997/98 season. The average angler thus spent some 26 days fishing and spent some N$ 3 400 doing it. Some 690 000 fish were caught, the mean weight of the daily catch was 6.06 kilograms, and the mean number of fish caught per day was 3.98. Of anglers, 46% were foreign, 38% were inland Namibians, and 16% were from coastal Namibia; 94% of anglers were male, the mean age was 45 years, and the mean income was N$115 680 per annum.

Travel cost model

Five visitation rate models were tested with different functional forms. The lin-log function had the best explanatory power for each of the five models. This is consistent with earlier research, where the semi-log function has been widely used (Ziemer *et al.*, 1980; Strong, 1983). All independent variables were, as expected, negative (i.e., the lower the travel costs, the more frequently anglers visit the coast). Further, they were all significant at the 99% level of significance ($p<0,01$). The modelling was thus successful and consistent with theory. Attempts to include other variables, such as income, in models were unsuccessful, with very low levels of significance and multicollinearity problems.

The base case model we selected for recreational angling can be described by the following function:

$$VPC = 0,004232 - 0,00055 \ln P \quad (2)$$

where *VPC* is the number of visits per capita and *P* is the trip cost. The travel cost method estimates, for trip expenditure and consumer surplus, differ markedly between angler categories. The mean consumer surplus per trip for foreign anglers was more than three times larger than that for the Namibians. Inland Namibians enjoyed a more than two times larger consumer surplus than did the coastal Namibians. However, seen as percentage of trip costs, the coastal Namibian anglers enjoyed the largest consumer surplus, while the foreign anglers had the smallest.

The inclusion or not of on-site and other non-travel costs (accommodation, food, entry fees, costs of capital items) in the model was tested in sensitivity analysis. The consumer surplus estimates were sensitive to their inclusion. This finding points to the need for care in determining which costs to include in travel cost analysis. As explained above, our base case model was based on full inclusion of these costs, since we consider that they affect visitation rates.

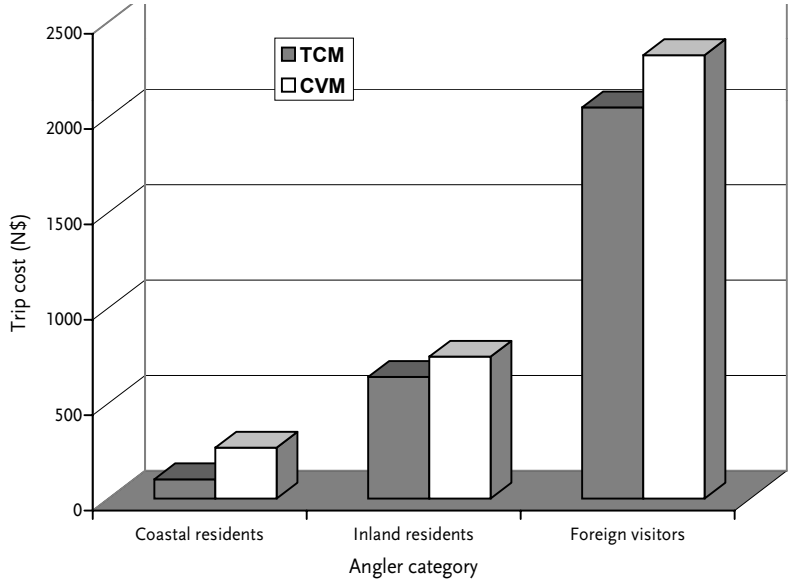

Figure 1. Estimates of mean angling trip costs for recreational shore angler categories, made using the travel cost (TCM) and contingent valuation (CVM) methods (Namibia, 1997/98).

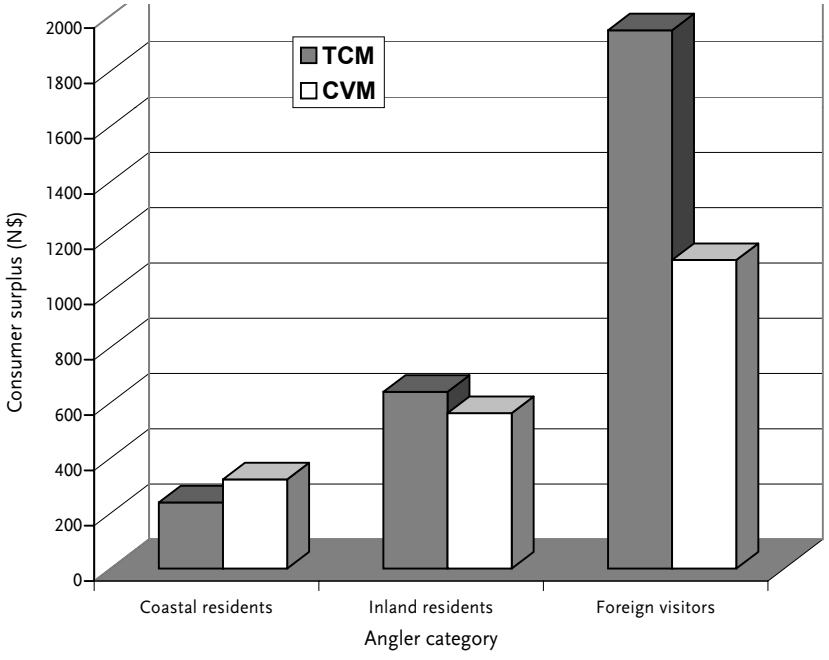

Figure 2. Estimates of mean consumer surplus for recreational shore angler categories, made using travel cost (TCM) and contingent valuation (CVM) methods (Namibia, 1997/98).

Contingent valuation

In the contingent valuation study, values from the payment card and open-ended questions were broadly comparable, and our findings confirm those of Kealy and Turner (1993), namely, that open-ended questions tend to give lower consumer surplus estimates than close-ended ones. The consumer surplus, in absolute terms, was greatest for foreigners. It was double that of the inland Namibians and more than triple that of the coastal Namibians. Expressed as percentage of expenditure, though, the coastal Namibians enjoyed a surplus of 121% compared with the foreigners' 48%.

Comparison of selected values from the travel cost and contingent valuation analyses is shown in Figures 1, 2 and 3. In Figure 1, the travel cost and contingent valuation estimates for trip costs are compared. In Figure 2 and Figure 3, the estimates for consumer surplus, and the consumer surplus expressed as a percentage of trip cost, are similarly compared. In all these comparisons there is remarkable consistency of pattern between the values. There is good consistency between techniques in estimation of expenditures, but in the estimation of consumer surplus, the travel cost method tends generally to yield higher values, particularly among foreign visitors.

Price elasticity of demand

Multiple regression models, constructed from the unaltered data, had extremely poor fit, were affected by multicollinearity, and were abandoned. Elasticity estimates were obtained, as explained above, from second-stage demand functions developed in the travel cost analysis, and derived price-

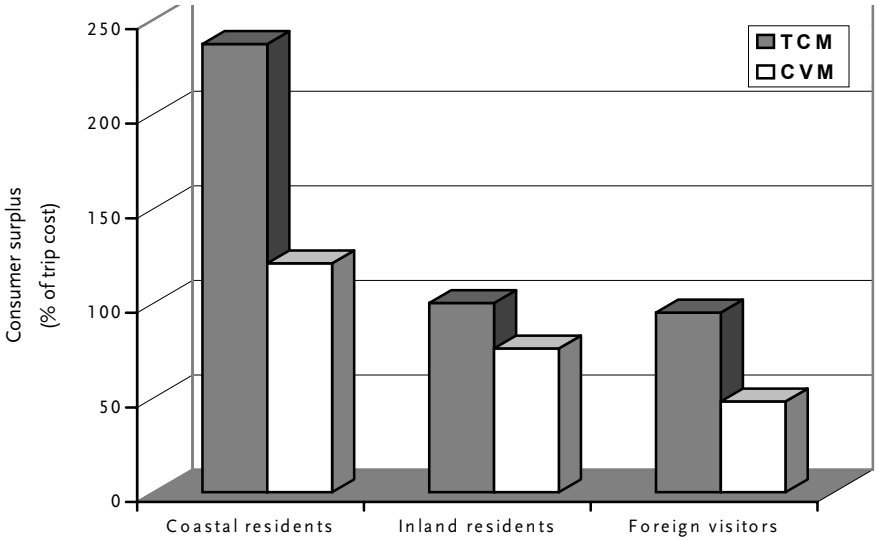

Figure 3. Estimates of consumer surplus, as percentage of trip cost, for recreational shore angler categories, made using travel cost (TCM) and contingent valuation (CVM) methods (Namibia, 1997/98).

quantity demand functions developed in the contingent valuation analysis. The lin-log form consistently provided good fit and significance. The second-stage lin-log travel cost demand function used is described as

$$Q = 18052.43 - 25.48 \ln P - 1186.61 \ln I - 837.02 \ln C \quad (3)$$

where Q is the quantity of angling trips, P is trip cost, I is angler annual income, and C is angler consumer surplus. This model shows a negative response to rising price, as expected, but (not as expected) negative signs to the income and consumer surplus variables. The derived lin-log demand function constructed from the contingent valuation (willingness to pay) data is described as

$$Q = 266.09 - 29.43 \ln Pw \quad (4)$$

where Pw is the willingness to pay for angling trips.

The results, shown in Table 1, suggest that demand of shore angling on the Namibian coast is price inelastic. The variation in values, depending on the model used, highlights the need for sensitivity analysis in such exercises. The simple regression models are mis-specified to the extent that other, possibly explanatory variables are omitted. Price elasticities derived from simple regressions were consistently higher than those from multiple regressions. True price elasticity is probably lower than indicated in Table 1, but comparison of results derived from the travel cost and contingent valuation models suggests broad consistency.

Table 1. Estimates of price elasticity of demand for angling trips among recreational shore-anglers (Namibia, 1997/98)

		Point elasticity at:	
	R^2	Mean price	Median price
Travel cost models			
Second-stage demand function			
Lin-log model*	1.00	-0.16	-0.15
Contingent valuation models			
Derived demand function			
Linear model**	0.73	-0.32	-0.21
Lin-log model**	0.93	-0.71	-0.58
Reciprocal model**	0.84	-1.03	-1.02

* multiple regression.
** simple regression.

Aggregate values

The aggregate angler numbers and mean values estimated for anglers were used to calculate aggregate economic values for the recreational shore fishery. The values for total direct expenditures, between N$23 million and N$31 million, are effectively measures of gross output for the recreational fishery. This gross output and the aggregated consumer surplus added together provide a gross measure of direct economic use value, between N$50 million and N$55 million. The part of this measure attributable to Namibia excludes the foreign consumer surplus (N$7 million to N$12 million). The value added to gross national income by the fishery is the proportion of gross output made up by gross value added (between N$11 million and N$15 million). Similarly, the value added to net national income is the proportion of gross output made up by net value added (between N$9 million and N$13 million).

Figure 4 shows a comparison between the aggregate expenditure and consumer surplus estimates, as derived from the three different techniques. There is general consistency in results, although the travel cost method tends to yield relatively lower value for direct expenditure, and relatively higher value for consumer surplus.

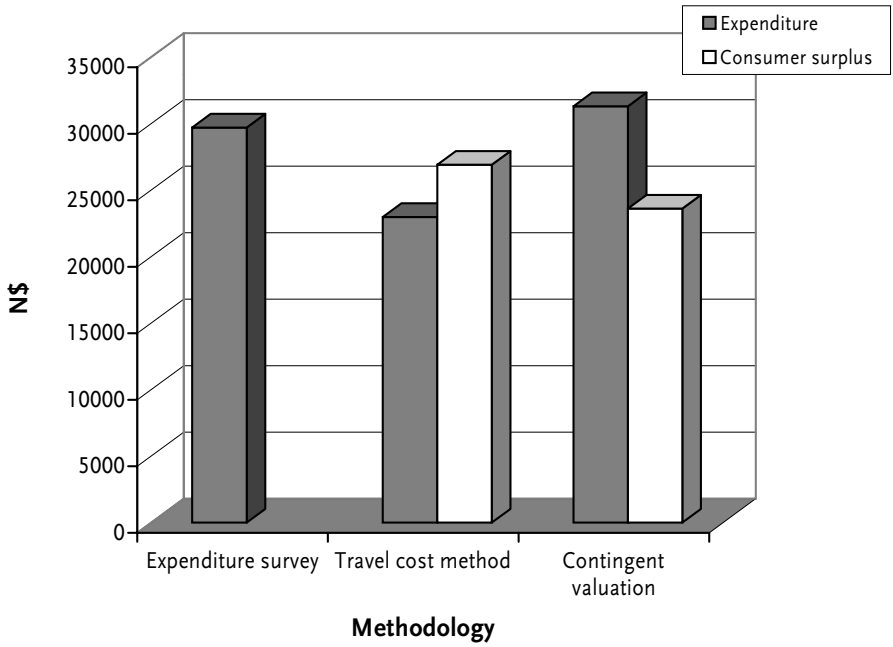

Figure 4. Estimates of aggregate direct expenditure and consumer surplus for the recreational shore fishery, as determined using expenditure analysis, travel cost method and contingent valuation (Namibia, 1997/98).

CONCLUSION

The studies reviewed have provided the authorities with considerable information to inform policy and management in the fishery. The recent introduction of angling licences and reduced bag limits reflect this. Comparison of results of Kirchner *et al.* (2000) and Zeybrandt and Barnes (2001) from Namibia with those of McGrath *et al.* (1997) and Brouwer *et al.* (1997) from South Africa, shows that Namibia's recreational shore fishery is very much smaller (between 2% and 5% of that in South Africa). There would seem to be potential for growth in the Namibian fishery but this needs to be planned with great care. More research is needed on bag limits, and the feasibility of promoting "catch and release" measures. Research is also needed to establish the most economically and biologically efficient allocation of line-fish stocks between the commercial fishery and recreational use. The gross value added of the recreational fishery (between N$11 million and N$15 million per annum) amounts to between 2,8% and 3,8% of the total gross value added in the whole Namibian fisheries sector, which was some N$391 million in 1996 (Central Bureau of Statistics, 1998). It thus has important value within the whole fisheries sector, which itself contributes some 4% of the Namibian national economy.

As we did, McGrath *et al.* (1997) found price elasticity of demand for recreational shore-angling in South Africa to be low. This confirms that the introduction of a fee is likely to be feasible, and that it will likely not reduce the size or growth of the fishery. The recent introduction of a licensing system will facilitate capture of rents.

The results of the work reviewed here are derived from several different methodological approaches. The roving creel survey was indispensable in providing absolute data on the numbers of anglers, and the catches made by them. The second survey, of 240 anglers entailed a targeted, stratified sampling technique, while the third survey, of 626 anglers, was less structured and aimed primarily at maximising respondent numbers. All yielded almost identical values for direct angler expenditure.

The analysis of the third survey data was done using two fundamentally different valuation techniques, the indirect travel cost method and the direct contingent valuation method. Here, comparison of the results shows remarkable consistency in pattern, and regular consistency in values. As a general rule, the travel cost method tended to yield relatively lower trip cost estimates and relatively higher consumer surpluses than the contingent valuation approach used. Sensitivity analysis, carried out on the travel cost models, where inclusion of on-site costs was varied, indicates that their full inclusion yields results closest to those of the contingent valuation. Use of both the travel cost and contingent valuation models to derive price elasticity

estimates is possible. Generally, greater variation is evident between estimates from different functional forms, than between estimates from the two types of model. It can be concluded that our use of the two widely disparate methods to value the recreational fishery has shown significant convergent validation of the economic measures. For best results all methods should be employed together, but each separately can provide useful values for policy analysis.

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